

FAA LICENSING AND THE NASA COMMERCIAL CREW PROGRAM

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Abstract

NASA's Commercial Crew Program (CCP) will develop two new human space flight vehicles that will be commercially operated and carry people to and from low Earth orbit. This innovative government and commercial partnership is a first for human space flight and builds on the success of NASA's Commercial Resupply Services (CRS) program that provides cargo and return services on commercially operated vehicles to support the International Space Station. Throughout NASA's history, human space flight has been overseen by NASA. In CCP, regulatory oversight for public safety will be done by the Federal Aviation Administration's Office of Commercial Space Transportation after NASA certification. The FAA currently licenses the launch and reentry of U.S. commercial providers under the CRS program and has licensed over 300 commercial launches since 1989.

The transition from a historically government-run activity to a government-commercial partnership has generated several safety challenges. NASA's focus is on crew safety and mission success for NASA missions while FAA's focus is on ensuring public safety on licensed launches or reentries. A Memorandum of Understanding (MOU) between NASA and FAA was signed in 2012 to avoid conflicting requirements and multiple sets of standards. One key consideration from industry's perspective is to be able to design a single vehicle that meets the needs of both NASA and future commercial customers, including affordable cost of operations.

This paper will describe the challenges and successes to date of the FAA's role in the Commercial Crew Program as a regulator of public safety in commercial space transportation. The paper will cover: changes in NASA oversight that led to NASA and FAA cooperation on Commercial Crew missions; interagency collaboration to resolve any barriers to licensing and ensure a smooth transition; the regulatory issues that needed to be addressed when flying government astronauts on FAA-licensed flights; and identify future challenges and milestones as the public safety oversight role transitions from NASA to the FAA. The purpose of the paper is to provide an understanding of new and innovative approaches to commercially operated space flight safety from a regulatory perspective while maintaining safety and reliability in commercial orbital human space flight.

1. Introduction

The prospect of commercial human space flight to orbit and back is rapidly approaching. Historically, the high cost, risk, national importance, and expertise needed to carry out human space flight has been solely in the realm of governments. With the emergence of increased commercial capabilities, potential for new markets and willingness to partner in risk, NASA's Commercial Crew Program (CCP) will soon produce commercially operated vehicles capable of carrying humans to low Earth orbit and back. The innovative program builds on the success of NASA's commercial cargo resupply to the International Space Station (ISS), which has strengthened U.S. commercial operators and resulted in significant cost savings to the U.S. Government.

During U.S. commercial launches and reentries, public safety and regulatory oversight is done by the Department of Transportation's Federal Aviation Administration (DOT/FAA). Since 1989, the FAA's Office of Commercial Space Transportation (AST) has licensed over 300 commercial launches and reentries.

The transition to a commercially operated business model in orbital human space flight while enabling the U.S. Government to meet its objectives for ISS operations means changes in how the government thinks and operates.

This paper will describe challenges and successes to date of the FAA's involvement in CCP. Important to understanding the current FAA and NASA relationship is a discussion of the FAA's Office of Commercial Space Transportation role and background, as well as NASA's partnership with commercial providers. The paper will discuss key changes that led to CCP establishing a relationship with the FAA, interagency collaboration to achieve national goals, inclusion of government astronauts on FAA-licensed flights, and how future challenges will be identified and overcome. The paper will provide an understanding of applying new approaches in CCP from a regulatory perspective while maintaining safety and reliability in commercial orbital human space flight.

2. Background on FAA Office of Commercial Space Transportation

The FAA Office of Commercial Space Transportation (FAA/AST) licenses U.S. commercial launch and reentry activities and the operation of launch and reentry sites by U.S. citizens or activities otherwise in the United States. The law establishing

DOT authority, the Commercial Space Launch Act of 1984, as amended, is 51 U.S.C. Chapter 509. The primary mission of FAA/AST is to "protect public health and safety, safety of property, and national security and foreign policy interests of the United States."¹ The office also has a promotion role to "encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the United States..."²

It is important to note that the FAA does not certify commercial launch or reentry vehicles. Instead, the FAA licenses the launch or reentry operation for public safety.³

The U.S. Congress has incrementally granted DOT/FAA oversight authority. Launch and launch site authority was granted in 1984. Reentry authority was added in 1998. Limited human space flight and experimental permits for suborbital vehicle testing were added in 2004.

One of the continual challenges for the FAA is to be able to write regulations that cover all different types of vehicle capabilities and missions to keep pace with industry while ensuring public safety.⁴

As commercial capabilities expand in low Earth orbit and beyond, the U.S. Congress is evaluating commercial "on-orbit authority" that is not already covered by other agencies such as the Federal Communications Commission or the Department of Commerce. Because the FAA only has launch and reentry authority, NASA retains oversight of operations that are near the ISS such as U.S. commercial cargo rendezvous and proximity operations for berthing/docking to the ISS.

3. Human Space Flight Authority at the FAA

In order to allow both the suborbital and orbital commercial human space flight industry to grow and develop, in keeping with incremental practice to date, the U.S. Congress has limited the amount of regulations that can be enacted.

With the passage of the 2004 Commercial Space Launch Amendments Act, the Congress granted the FAA limited human space flight regulatory authority but did not give the FAA authority to protect people onboard spacecraft. Industry would be responsible for occupant protection and the Congress established an industry "Learning Period" of eight years before the FAA could initiate additional human space flight

regulations. Since 2004, the Congress has extended the Learning Period or “moratorium” deadline three times and could again. Currently, the sunset date is October 2023.⁵

The 2004 law established a new term, “Space Flight Participant,” (SFP) to differentiate between traditional “passengers.” A passenger in aviation has no training requirements and has a reasonable expectation of minimal risk because the airplane they are flying on has been certified as safe by a regulator. In contrast, under FAA space regulations, an SFP is not a crewmember and the operator must be inform them of risks they are taking, told that the US Government has not certified the vehicle they are riding on, and sign a document that recognizes there are risks, both known and unknown. These requirements form the basis of what is called an “informed consent regime.”⁶ In addition, CFR 460.51 states that “[a]n operator must train each space flight participant before flight on how to respond to emergency situations, including smoke, fire, loss of cabin pressure, and emergency exit.”

Other FAA human space flight regulations for the operator include environmental control and life support systems, human factors, verification, crew and space flight participant waiver of claims, and security.⁷

Although the FAA cannot yet establish regulations to protect people on board, the FAA does have a responsibility to promote the continuous improvement of the safety of launch vehicles designed to carry humans. Working closely with NASA and industry, in 2014, after a three-year effort, the FAA published “Recommended Practices for Human Space Flight Occupant Safety.”⁸ The recommendations are voluntary for industry. While the 90 mostly performance-based practices could serve as starting point for future rulemaking, they were also meant to capture important safety practices and identify subject areas that could benefit from industry consensus standards.

The FAA, in developing the recommend practices, used requirements from NASA’s CCP were used as a concept baseline. Specifically, the FAA used:

- CCT-PLN-1120 – Crew Transportation Technical Management Processes;
- CCT-REQ-1130 – ISS Crew Transportation Services Requirements Document; and
- CCT-STD-1150 – Crew Transportation Operations Standards.

Until the FAA has full oversight over human space flight safety and regulations in place, industry and NASA will need to fill the gap.

4. Traditional Model Meets the Commercial Model

Under a traditional government approach for human spacecraft from the Mercury capsule to the Space Shuttle:

- NASA devised the requirements;
- NASA engineers and specialists oversaw every development aspect of the spacecraft, its support systems and operations plans;
- A contractor was hired to build to NASA design criteria and the standards;
- NASA personnel were heavily involved in the processing, testing, launching and operation to ensure safety and reliability; and
- NASA owned the spacecraft and its operating infrastructure.⁹

Under the new commercial approach:

- Companies are free to design the transportation system they think is best;
- The companies are encouraged to apply their most efficient and effective manufacturing and business operating techniques;
- NASA’s technical expertise and resources are accessible to a company;
- The companies own and operate the spacecraft and infrastructure.¹⁰
- For the contracts phase of development and certification:
 - Each company must meet NASA’s pre-determined set of requirements;
 - NASA will have oversight of a limited set of critical milestones;
 - The companies accept development risk in a fixed priced contract (not the standard cost-plus contract); and
 - Companies must demonstrate their investment in the contract.

Under this new commercial approach, the CCP launches (or reentries) are no longer conducted by and for the U.S. Government.¹¹ As a result, CCP missions are considered commercial by the FAA because the company has significant responsibility for the vehicle.

The U.S. Government has used the option of commercially operated launches several times. Of the 319 FAA-licensed and permitted launches during 1989-2017, 58 of those launches flew primary

payloads owned by the U.S. Government. These include NASA cargo missions to the ISS and launches of Air Force, Navy, and NOAA satellites. For these missions, the U.S. Government chose not to be substantially involved in the launch and as such, they are commercially operated and therefore licensed by the FAA. In other words, responsibility for launch mission success is by the commercial launch operator.

5. Getting to a Commercial Service

Reducing risk for humans on vehicles during space flight is of supreme importance to NASA. At stake is not only the safety of NASA astronauts but also ISS partner astronauts and cosmonauts. Could that be achieved at a commercial level when FAA did not have vehicle certification authority nor authority to protect people onboard? Just like the trend-setting Commercial Resupply Services program, going the commercial route meant changes in how NASA approached human space flight.

Unlike the Space Shuttle which NASA owned, NASA does not own the commercial vehicles. This key difference gives industry the opportunity to use their design to not only meet NASA's needs but also commercial needs. This has the potential to reduce NASA costs and enable a company to expand into new markets. To further reduce costs and encourage industry innovation, NASA gave the commercial partners decision-making freedom. NASA did this by removing some prescriptive requirements and replacing them with high-level requirements performance requirements and allowing industry to decide how best to meet them.

6. Background on NASA Commercial Crew Program

After the Space Shuttle was retired, NASA relied on Russian Soyuz spacecraft to get astronauts to and from the International Space Station. Although workable, it was not an ideal situation. The success of the U.S. Commercial Orbital Transportation Services program and resulting ISS cargo resupply partnerships brought forth a question: could the same commercial model work for a new crew vehicle?

Missions in CCP would be structured in three phases that played to the strengths and authorities of NASA and FAA while incentivizing and moving industry partners on a competitive path to commercial operations:

- Concept development and testing;
- Design certification and test missions; and
- Post-Certification Missions (PCMs).

During the first phase, a competition under a NASA Space Act Agreement, test launches or reentries would be carried out by commercial providers (such as SpaceX's pad abort test) and therefore licensed by the FAA.

In phase 2, completion of vehicle development and certification for NASA missions would occur. In September 2014, NASA announced contracts for Commercial Crew Transportation Capability (CCtCAP). Multibillion-dollar contracts were awarded to two companies: Boeing to continue development of the CST-100 capsule and to SpaceX to continue with the Dragon crew capsule. The contracts cover two certification test flights and two operational missions per company with options for additional operational missions. Since the initial contract, additional options were awarded for a total of six operational missions per provider.

Certification flights would be fully overseen and directed by NASA to verify compliance with NASA requirements and standards. During test flights, NASA would have oversight of astronaut safety, mission assurance, and public safety. As a result, these government certification missions would not be licensed by the FAA.

The providers will have completed certification when NASA is satisfied they meet the NASA requirements. The intent thus far is to have one uncrewed flight and one crewed flight before completing certification and moving on to FAA-licensing. A flight schedule was announced in August 2018 (see Table 1).

Table 1. Commercial Crew Program Flight Schedule

	SpaceX Dragon on Falcon 9	Boeing CST-100 Starliner on Atlas V (ULA)
Uncrewed Demonstration	November 2018	Late 2018 or early 2019
First Crew Flight	April 2019	Mid-2019

For phase 3, post-certification, NASA, once satisfied their requirements are met, would hand oversight of public safety over to the FAA. Accordingly, the launch and reentry of post-certification missions are licensed by the FAA. NASA retains responsibility for astronaut safety and mission assurance during FAA licensed missions.

7. Trending Toward Performance Requirements

NASA was faced with a major challenge on how to allow for industry innovation while maintaining safety. NASA had a large number of vehicle requirements that had been proven over time in human space flight. These detailed and strict requirements had the potential to hamstring industry innovation. The space agency found the middle ground in CCP. NASA established its high-level needs and then delegated to industry derivation of the lower level vehicle and operation requirements that would support the macro requirements. While detailed requirements remained where appropriate, NASA wrote many high-level, performance-based requirements that gave industry flexibility. For example, NASA required four ISS crewmembers to be safely returned after a six-month stay.

Furthermore, as a result of a reduced set of requirements and NASA delegating responsibility to the provider, after certification, vehicle operation transitions to the commercial realm. Accordingly, the FAA has oversight responsibility for public safety and NASA range safety requirements are not in effect.

In this new commercial environment, to determine if there would be overlaps in each agency's current authority or requirements, NASA and the FAA agreed to work together to flush out any issues early and resolve them. To formalize this review, NASA and FAA signed an agreement.

8. MOU between NASA and FAA

In June 2012, the FAA and NASA signed a Memorandum of Understanding (MOU) to coordinate standards together for operational commercial crew missions to and from Low Earth Orbit, including the International Space Station.

The most important policy established in the MOU is that during commercial crew missions:

- FAA is responsible for public safety
- NASA is responsible for crew safety and mission assurance.¹²

The MOU committed NASA and FAA to avoid duplication and conflicts in their respective authorities while advancing both public safety and crew safety. The benefit to industry would be establishment of a "stable framework" that was understood in advance by commercial providers.

The MOU also established the government's intent to have FAA license ISS services missions.

NASA would buy transportation and rescue services to the ISS after NASA certified the commercial providers.¹³

"This MOU is intended to support the transition to commercial transport of Government and non-Government passengers to low-Earth orbit in a manner that avoids conflicting requirements and multiple sets of standards. In developing these standards, the parties will exchange knowledge and best practices in the disciplines of space flight health, medical, engineering, and safety and mission assurance requirements for space systems and vehicles and operations."¹⁴

As part of implementation, the FAA co-located personnel at the Johnson Space Center and the Kennedy Space Center. NASA also assigned a few employees to work a temporary detail at FAA Headquarters in Washington. Working together, both agencies identified tasks, goals, objects, documents, and schedules needed to enable successful licensing of commercial crew missions.

9. Collaboration to Enable Licensing and Minimize Burden to Government and Industry

When the FAA and NASA first started working together on CCP missions, little was known about the vehicle design and operations. Hypothetical vehicles combined with different agency methods, cultures and requirements resulted in relationship growing pains. NASA had concerns the regulations, being law and difficult to change, would prevent them from carrying out their mission. While the forward path was not clear at the time, both sides remained committed to success.

Government collaboration made significant progress when teams from both agencies met face-to-face in 2012 to compare and contrast each other's requirements line-by-line. At those meetings, the teams identified approximately 100 issues needing investigation. Simple clarifications and consolidation of similar items allowed the team to quickly reduce the number of issues to less than 50. The topics generally fell into the following groups: payload, definition questions, range safety, crew issues and liability. Working together, both agencies discovered the differences were not insurmountable, but acknowledged work was needed to address the issues.

To aid in resolving the potential barriers to FAA licensing and avoid agency duplication of effort,

three main teams eventually formed to close out the 100 issues:

- Launch & Entry Steering Group (LESG) – a joint NASA, FAA, and Air Force chaired meeting formed to resolve range safety policy issues
- Legal Harmony Working Group – NASA and FAA team formed to address liability and legal questions
- Technical issue team – joint NASA and FAA team formed to resolve technical, analysis and operational issues

The FAA and NASA also formed specific teams to address challenging specialized topics such as reentry risk.

As a method to document roles and responsibilities and address some of the open issues, the agencies developed a joint Program Management Plan (PMP). The PMP expands upon the Joint FAA/NASA MOU and has the following primary goals:

- Identify efficient technical data exchanges to reduce duplicative requests of the Commercial Providers;
- Share information and resources to the greatest extent practicable to preclude any unnecessary overlap or duplication of effort;
- Ensure each agency has the appropriate level of information and insight to execute its responsibilities under their respective authorities; and
- Define the roles and responsibilities that each agency plays throughout the program and mission life cycle.

To achieve these goals, NASA and the FAA work together to ensure a mutual understanding of each agency's goals and requirements while seeking efficiencies in the process. Figure 1 depicts this interdependent relationship. The Commercial Providers must distribute to both NASA and the FAA their deliverables in satisfaction of their respective NASA contract and FAA license requirements. NASA and the FAA will each execute their respective roles consistent with their government oversight responsibilities. However, NASA and the FAA agree collaboration between the agencies on common technical information and insight data, as well as sharing of resources, will help to achieve safe commercial space transportation while minimizing the burden on the Commercial Providers.

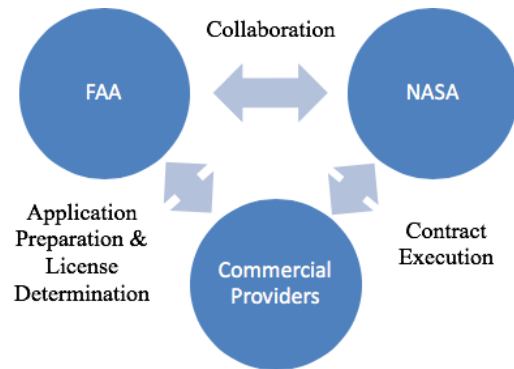


Figure 1: Partner Relationships

Within the PMP, many of the 100 initial issues have been addressed or resolved. Items addressed include Maximum Probable Loss (MPL), Payload Review, Emergency response, and Government astronauts.

The FAA determines the MPL value as part of its standard licensing process, 14 CFR Part 440. This analysis established the licensee's financial responsibility they must cover (e.g. insurance) for possible third party bodily injury or property damage as a result of their launch or reentry activities. To remain consistent with the FAA MPL requirements that will be imposed on the contractors during licensed activities, NASA mimics licensing on the CCP certification flights by requiring liability responsibility in the contract. Given the FAA already has the tools and expertise to calculate MPL, and NASA does not, the FAA agreed to perform an MPL analysis and provide it to NASA for the CCP certification flights. This way the government avoids unnecessary duplication because NASA will not have to stand up its own MPL analysis team. The commercial providers benefit because in using the FAA-provided analysis they can purchase the appropriate amount of liability insurance just as they would for a licensed launch or reentry.

The FAA must perform a payload review as part of the licensing process; however, NASA already conducts a thorough review of payloads going to the ISS. Each agency identified this as an area where the government could avoid duplicative and unnecessarily burdensome process. In the PMP, the FAA agreed that for the payload review on licensed flights, the Commercial Provider could provide the NASA payload safety data package (including ground and flight hazards) to the FAA for review and consideration as part of the payload review process. The FAA in the past has accepted NASA's

characterizations and hazard assessment of the contents (such as food and equipment).

To address NASA concerns about emergency responses conflicting with regulatory requirements, in the PMP, the FAA agreed normal coordination may not be possible during an unexpected event that requires immediate action necessary for astronaut survival or to prevent serious injury from occurring during launch or reentry. The FAA pointed out it has the ability to allow real-time deviations and has allowed them in the past. For example, in an in-flight emergency requiring immediate action, the pilot in command may deviate from the license to the extent required to meet the emergency. The FAA documented in the PMP that grants authority for this type of deviation in its aviation regulations, and has also previously allowed for this type of deviation through the terms and conditions section of the launch or reentry license.

The most recent agreement reached in the PMP dealt with the government astronaut category. NASA and the FAA worked to provide an approach to implement complementary reviews to preclude any unnecessary overlap for FAA applicants carrying government astronauts on CCP vehicles. The FAA assessed CCP requirements and found they sufficiently addressed FAA concerns regarding training, human factors, smoke detection and life support system capability. The PMP documents FAA agreement that license applicants performing CCP missions may cite the relevant NASA documents along with accepted evidence of compliance as evidence of regulatory compliance. This approach helps the FAA in an evaluation because these parts have already been evaluated for compliance that reduces duplicative documentation and reviews for the FAA and commercial provider. Before these government astronaut agreements could be even be contemplated, the category first had to be created in order to solve some significant problems that could have hampered licensing of CCP missions.

10. Government Astronauts

One of the most challenging issues the FAA and NASA overcame was the government astronaut predicament. The Commercial Space Launch Amendments Act (CSLAA) of 2004 anticipated flying humans on commercial space vehicles, but not NASA astronauts because at that time, NASA had its own human space flight vehicle, the Space Shuttle. The CSLAA did not foresee the retirement of the Space Shuttle and current events where NASA would utilize commercial space vehicles to fly U. S.

Government civil servant, military and International Partner astronauts to the International Space Station. To address this, the FAA and NASA formed a joint team of lawyers and engineers to assess the impacts of the CSLAA on CCP missions. The team identified three key hurdles to overcome: crew being employees of licensee, waiver of claims against the U.S. Government and informed consent.

The CSLAA defines crew as “any employee of a licensee or transferee, or of a contractor or subcontractor of a licensee or transferee, who performs activities in the course of that employment directly relating to the launch, reentry, or other operation of or in a launch vehicle or reentry vehicle that carries human beings.” This becomes problematic because only crewmembers are permitted to pilot or operate a launch or reentry vehicle. Since U.S. Government and International Partner astronauts are not employees of a licensee, they can only fly as Space Flight Participants (SFPs).

For public safety reasons, SFPs have an extremely limited role and are not allowed to pilot a launch or reentry vehicle. Placing U.S. Government or International Partner astronauts in this category potentially conflicted with their expected duties. The team spent months reviewing anticipated duties required during a launch or reentry looking for potential solution paths.

NASA felt they might accept the SFP classification, and associated piloting limitations, on CCP missions as long as the astronauts could conduct operational duties related to emergencies such as system monitoring and abort activation. In order to formally document this understanding, NASA requested a legal interpretation from the FAA. The FAA responded favorably to NASA that NASA astronauts classified as SFPs on CCP missions, based on a number of facts, most notably that as a result of automation during nominal flight, could perform emergency related duties because during nominal flight “any persons on board would not likely affect the flight path of the launch vehicle.” Beyond the issue of being able to pilot the vehicle, the joint legal team addressed other obstacles.

For commercial space travel, the CSLA requires crew and SFPs to execute reciprocal waivers of claims releasing the United States Government (USG), its contractors and subcontractors from claims for personal injury, death, or property damage sustained by the SFP during licensed activities, regardless of fault. This becomes problematic for

USG employees because they have the right to seek compensation for injury to them during the course of their employment. Signing a waiver, that the astronaut would hold the USG harmless, is contrary to the rights of USG employees. To address this, the FAA provided another legal interpretation, stating USG civil servants or military personnel are not required to sign waivers, as SFPs must. The FAA consulted with the Department of Labor on this issue and came reached this conclusion based on the fact the CSLA could not repeal the rights afforded to government personnel in the Federal Employees Compensation Act.

Informed consent created another difficult situation for USG and International Partner astronauts. The FAA requires SFPs to sign informed consent stating they have been informed of the risks of space flight and their participation is voluntary. This caused problems because: 1) NASA as an agency assesses and accepts the risk of space flight for their astronauts; and 2) US government astronauts performing official business, likely could not be considered voluntary. Complicating the matter even more is the fact that informed consent must be accomplished before any compensation or agreements to fly occur. NASA's contractual payments and agreements might not align to the timing required by informed consent.

While the FAA and NASA continued to work through these issues, a legislative change was deemed the simplest and best option for resolution. The team drafted a joint legislative proposal and in February 2015, the FAA and NASA administrators sent a letter to Congress proposing the legislative change. The proposal recommended adding a definition for "government astronauts" to the two existing definitions for "Crew" and "Space Flight Participants." Since the current definitions and licensing requirements were intended for space tourism, they did not consider the unique aspects and requirements of transporting government employees and international partner astronauts to the International Space Station (ISS) on commercial vehicles. The letter also emphasized legislation was needed to resolve and clarify the application of the CSLAA in order to keep the program on schedule.

Congress responded to the joint legislative request and in November 2015 passed, and the President then signed the U.S. Commercial Space Launch Competitiveness Act (CSLCA), thereby enacting the "government astronaut" provisions.¹⁵ The CSLCA added a definition to the law creating a third category

of space occupant on FAA-licensed launches and reentries: 1) crew, 2) SFPs and, 3) government astronauts. U.S. civil servant and military astronauts, and the ISS International Partner astronauts will not have to fly as SFPs. They will be able to perform their duties under FAA's licensed flights, as appropriate, while preserving their rights as either government employees or ISS International Partner astronauts performing official duties.

11. Future Challenges and Conclusion

In May 2018, the President issued Space Policy Directive-2, "Streamlining Regulations on Commercial Use of Space" after discussions within the National Space Council. The Secretary of Transportation was directed to review regulations for licensing of commercial space flight launch and re-entry. The directive asked the Secretary of Transportation to consider 1) "requiring a single license for all types of commercial space flight launch and re-entry operations" and 2) "replacing prescriptive requirements in the commercial space flight launch and reentry licensing process with performance-based criteria."¹⁶

The impact of this regulatory reform has yet to be determined. The FAA plans to release a Notice of Proposed Rulemaking by February 1, 2019 that will address the policy directive.

The FAA, NASA, and industry, in the spirit of goodwill and partnership, have done their best to uncover any barriers or issues to FAA licensing of CCP missions. With the majority of issues and challenges resolved, those remaining tend to be operational in nature.

To identify and address any operational issues early, the FAA, in consultation with NASA and its contractors, has agreed to participate in the upcoming NASA certification missions as an observer. Following along in the timeline, procedures and observing the mission and interactions will allow the FAA to identify any barriers to licensing or conflicts in authority early, allowing time for the FAA and NASA to resolve them without impact to the mission.

References

¹ 51 USC Chapter 509 is available at https://www.faa.gov/about/office_org/headquarters_offices/ast/legislation_policies/

² Ibid. Executive Order 12465 was signed by President Reagan in February 1984, before Congress passed the CSLA. The Executive Order designated the Department of Transportation as the lead agency within the Federal government for encouraging and facilitating commercial ELV activities by the United States private sector.

³ See “Certification Versus Licensing for Human Space Flight in Commercial Space Transportation,” Federal Aviation Administration, IAC-12-D6.1.3, (2012 International Astronautical Congress) Available at:

https://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs/

⁴ FAA regulations can be found at:

https://www.faa.gov/about/office_org/headquarters_offices/ast/regulations/

⁵ See USC Chapter 509 § 50906. The third “Learning Period” extension to 2023 was included in the 2015 U.S. Commercial Space Launch Competitiveness Act, signed by the President in November 2015. The first extension to the 2004 law was for three years in February 2012. The second extension for only six months in September 2015 allowed more time for the 2015 CSLCA to pass. During the Learning Period, the FAA is allowed by Congress to issue regulations restricting or prohibiting design features or operating practices that have either resulted in a serious or fatal injury to crew or space flight participants during a licensed or permitted commercial human space flight, or contributed to a “close call.”

⁶ Text from the Human Space Flight Requirements in the U.S. Code of Federal Regulations (CFR) 460 is available at

https://www.faa.gov/about/office_org/headquarters_offices/ast/regulations/

See also “Informed Consent in Commercial Space Transportation Safety,” Federal Aviation Administration, IAC-13-D5.1.4, (2013 International Astronautical Congress). Available at: https://www.faa.gov/about/office_org/headquarters_offices/ast/programs/international_affairs/

A working group from FAA’s industry advisory committee, COMSTAC, prepared a 2008 task force report on “Commercial Human Space Operations Training Standards. The report is available at: https://www.faa.gov/about/office_org/headquarters_offices/ast/reports_studies/archives/

⁷ Human Space Flight Requirements text from CFR 460 is available at

https://www.faa.gov/about/office_org/headquarters_offices/ast/regulations/

⁸ “Recommended Practices for Commercial Human Space Flight Occupant Safety, FAA, August 2014. The 56-page document is available at:

https://www.faa.gov/about/office_org/headquarters_offices/ast/news_announcements/

⁹ “Commercial Crew Program- The Essentials,” NASA Commercial Crew website [undated] <https://www.nasa.gov/content/commercial-crew-program-the-essentials/#.VjOJ3berRaT>

¹⁰ Ibid.

¹¹ According to 51 USC § 50919, “This chapter does not apply to— (1) a launch, reentry, operation of a launch vehicle or reentry vehicle, operation of a launch site or reentry site, or other space activity the Government carries out for the Government.”

¹² “Memorandum of Understanding between the Federal Aviation Administration (FAA) and the National Aeronautics and Space Administration (NASA) for Achievement of Mutual Goals in Human Space Transportation.” FAA, NASA, June 2012, https://www.faa.gov/about/office_org/headquarters_offices/ast/about/moa_mou/

¹³ Ibid.

¹⁴ Ibid.

¹⁵ U.S. Commercial Space Launch Competitiveness Act, Section 112 (Public Law 114-90), November 25, 2015.

<https://www.congress.gov/114/plaws/publ90/PLAW-114publ90.pdf>

¹⁶ “Space Policy Directive-2, Streamlining Regulations on Commercial Use of Space,” The White House, May 24, 2018. <https://whitehouse.gov/presidential-actions/space-policy-directive-2-streamlining-regulations-commercial-use-space/>